©EASTMAN KODAK: ©Kodak introduces new DirectView web distribution system, medical image streaming technology boosts retrieval speeds

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Eastman Kodak Co*Ticker:***EK***Duns:***00-220-6183***Sic:***333315***Sic:***325221***Sic:***325211**

Abstract:
M2 PRESSWIRE-31 July 2001-©EASTMAN KODAK: ©Kodak introduces new DirectView web distribution system, medical image streaming technology boosts retrieval speeds (C)1994-2001 M2 COMMUNICATIONS LTD LAS VEGAS -- ©Eastman Kodak Company today introduced its new Kodak DirectView Web Distribution system, continuing ©Kodak's tradition as a leader in web-based image and information distribution. This web-based system employs innovative medical image streaming technology (MIST) to enable faster transmission of radiology reports and full-fidelity medical images over all types of networks and dial-up connections. With MIST technology, additional data behind the displayed image is "painted in," allowing users to view a requested image in three to four seconds, while other detail transmits in the background. "In the past, lossy images could be rendered pretty quickly, but higher quality lossless images carried significant transmission delays, even with ISDN lines," said Gary Larson, general manager of imaging and information systems, and vice president of Kodak's Health Imaging Division. "This method of streaming pixels improves the performance of all retrievals, and will be especially noticed by physicians using slower local area networks or dial up connections." The new web server can be connected to a hospital or radiology information system or to a PACS (picture archiving and communications system) and can transmit images to remote physicians, clinics and hospitals. The server supports enhanced security when connected with an SSL encryption device, in addition to providing user identification and password prompts. Access to patient images and information can be restricted to users in each patient's medical team, including primary care, hospital-based physicians and local or remote specialists. The server is available with 500 gigabytes of on-line storage.

Full Text:

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method of streaming pixels improves the performance of all retrievals, and will be especially noticed by physicians using slower local area networks or dial up connections." The new web server can be connected to a **hospital** or radiology information system or to a PACS (picture archiving and communications system) and can transmit **images** to remote physicians, clinics and **hospitals**. The server supports enhanced security when connected with an SSL encryption device, in addition to providing user identification and password prompts. Access to patient **images** and information can be restricted to users in each patient's medical team, including primary care, **hospital**-based physicians and local or remote specialists. The server is available with 500 gigabytes of on-line storage. Systems with 120 gigabytes, and larger 1 terabyte and 1.5 terabyte systems, will be available later this year. Benefits of Web-Based Distribution For **hospitals**, electronic distribution eliminates the time, cost, and labor of producing and distributing film **images** and radiology **reports**. Simultaneous electronic access to **images** can increase the value of radiology **reports** and can enhance telephone **consultations**, since referring physicians can review the **images** during the **consultation**. Electronic **image** and **report** distribution can also enhance revenue by increasing the number of referrals. At the same time, electronic access to **images** can boost physicians' productivity, and physicians can use **images** to enhance patient communication and education. Enhanced, Basic Web Viewers The Kodak DirectView Web Distribution system offers both basic and enhanced viewing of **images** and information from the web server with its standard and enhanced Kodak DirectView WX Workstation Software. Both products are easy to use because they work with Microsoft Internet Explorer and Netscape Communicator to display the **images** and access the server. As part of the server package, each facility receives an unlimited number of licenses for the basic viewer and can purchase enhanced viewer licenses to suit their needs. The enhanced WX Workstation Software delivers full-fidelity, 12-bit medical images on a standard personal computer. The viewer provides a full set of image manipulation tools including: window/level, magnify, zoom, pan, rotate, basic cine-image playback, search, and layout retention. Basic measurement tools are also included. The standard WX Workstation Software delivers high-quality 8-bit JPEG images to remote computers through a web browser. Because the basic viewer is free, it is an ideal way for referring physicians to access reports and images. Basic image manipulation tools are provided including: window/level, magnify, zoom, rotate and fit. Both standard and enhanced workstation software is compatible with most personal computers using Windows 98 and Windows NT operating systems, and running Microsoft Internet Explorer or Netscape Communicator. The standard workstation software will also display images on computers with Mac OS and Unix operating systems. About Kodak Health Imaging and Infoimaging Kodak's Health Imaging Division is a leading participant in infoimaging, a $225 billion industry created by the convergence of image-and-information technology. The division develops, manufactures and markets products for the capture, processing, presentation, distribution and printing of health- related images and information. Among its products are picture archiving and communications systems, radiology information systems, computed radiography, digital radiography, teleradiology, laser imagers, desktop medical imagers and traditional mammography and x- ray films. Health Imaging has annual revenues of more than $2 billion, and has served the healthcare industry for more than 100 years. Infoimaging unites three closely related imaging markets that enable people to more easily take and share images as information: devices, such as computed radiography and digital radiography systems; infrastructure, such as networks; and services/media. For more information about Kodak's Health Imaging Division, call 1-877/ 865-6325, Ext. 227 (United States only), contact your @Kodak representative or visit @Kodak's web site at www.kodak.com/go/health. ((M2 Communications Ltd disclaims all liability for information provided within M2 PressWIRE. Data supplied by named party/parties. Further information on M2 PressWIRE can be obtained at http:// www.presswire.net on the world wide web. Inquiries to info@m2.com)).

Surmounting health information network barriers: The greater Dayton area experience

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Abstract:
The greater Dayton area has begun building the nation's first advanced technology network for sharing patient medical information among independent hospitals. Its success in doing so has resulted from the surmounting of numerous business and technical barriers. Others planning to develop such networks can learn from the Dayton experience.

Full Text:

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[Headnote]
Key words: community health information network (CHIN), computer-based patient medical record,

hospital information systems management

The greater Dayton area has already taken steps to surmount major barriers facing communities seeking to build health information networks and has developed the nation's first advanced technology community network and associated solutions for sharing patient medical information among independent hospitals. Many observers have told us that our community collaboration is unique and that while many other communities are talking about building community health information networks (CHINs), we are on the leading edge in actually building one. Although our journey is not complete, we hope the following description of our experience will benefit health care in other communities.

REASONS FOR CHINS AND THE BARRIERS TO SUCCESS

Health care providers and proponents of managed care view the sharing of patient medical information among hospitals, physicians, payers, and other health care stakeholders as essential for supporting better quality and more cost-effective health care. Since health care is delivered primarily at the local level, the sharing of patient medical information to improve health care will yield its greatest benefits if an information-sharing network infrastructure is established at the local level, this is to say, a metropolitan community and its surrounding counties. Future health care delivery will rely on CHINs to support interconnection of health care players primarily within a community but secondarily across communities.

Barriers to developing computer-based systems for sharing information have severely limited opportunities for the health care improvements expected from CHINs. Business barriers include limited incentives for competitors to collaborate in developing community networks and high infrastructure costs for starting and operating a network. These barriers prevent a critical mass of health care stakeholders with a variety of applications from participating in a community network. This critical mass of participants and applications is needed to spread high infrastructure costs and provide a net benefit to participants. Technical barriers include the lack of a standard computerbased patient record, the existence of a large number of diverse hardware and software systems in hospitals and physician offices, and the lack of standards for accessing, retrieving, and communicating confidential patient information from a variety of distributed sources.

THE GREATER DAYTON AREA PATIENT HEALTH INFORMATION NETWORK

Getting started

What led competing hospitals in this community to collaborate? Did they have a business incentive? Did they have a mandate? The Greater Dayton Area Patient Health Information Network found its roots in a simple question about the ability of physicians at one local hospital to check on patients in other area hospitals using an electronic medical record.

In January 1993, with help from the Greater Dayton Area Hospital Association (GDAHA), the medical records directors and heads of information systems in six competing GDAHA hospitals-Children's Medical Center, Good Samaritan Hospital and Medical Center, Grandview Hospital, Kettering Medical Center, Miami Valley Hospital, and St. Elizabeth Medical Center-met to discuss the status of a computerbased patient medical record (CPR) in their hospitals and the possibilities for the future. Although everyone foresaw future implementation of a CPR, no one expected an immediate implementation of an integrated health information network.

At the same time, ®Ameritech began looking for projects in the Dayton area to demonstrate the value of a fiber optic network. It agreed to support a proposed demonstration project involving the six hospitals sharing patient medical records. This project appeared to meet the criteria of its quest for alternative forms of regulation and related commitment to the governors of the Great Lakes states to upgrade the states' communications infrastructure; furthermore, it provided an opportunity to develop new business.

The demonstration project was brought to the attention of ®IBM, which is a major technology supplier to five of the six hospitals. ®IBM proposed to support the hospitals' use of the Medical Records Plus/400 image processing hardware and software solution to store and display patient medical records. ®IBM viewed its participation as an opportunity to establish market leadership and develop new business.

The ®Ameritech and ®IBM proposals were subsequently presented to the group discussing the CPR. Although the demonstration project did not necessarily meet the mission of developing a computerized patient record, the group concurred that it would aid in attaining this mission since it would be a way to begin linking the hospitals, and it would

provide considerable computer and communications technology and services to the hospitals at little out-of-pocket cost. The Community Patient Health Information Network (CPHIN) task force was formally established under the auspices of GDAHA with approval of the hospitals' chief executive officers.

The guiding vision and funding commitments

The vision guiding the task force had three phases. The first phase involved interconnecting the hospitals to share patient medical records. This phase lasted for 2 years. The second (current) phase envisions expanding the scope of the network to other hospitals in GDAHA as well as physicians. The third phase envisions expanding the network to the rest of the stakeholders in the health care continuum.

To initiate the first phase, the CPHIN committee began researching available outside sources of funding to help realize this vision. The University of Dayton joined the committee's efforts to help seek external funds and to facilitate an independent evaluation of the project. The University saw its early contribution as an opportunity to provide community service, conduct research, and develop support for subsequent participation in the project. A proposal for going beyond basic patient information sharing was developed for the Advanced Research Projects Agency (ARPA) of the U.S. Department of Defense. At this time the CPHIN committee also solicited U.S. Air Force Medical Center Wright-Patterson, a regional military medical center and member of GDAHA, to become a part of the project. Developing the proposal led ©Ameritech, participating hospitals, ©IBM, and the University of Dayton to commit approximately $5 million to the project. For the reasons noted above, these commitments were promised even if ARPA funding did not materialize.

Without waiting for the ARPA funding, the partnership began collaborating to build the Greater Dayton Area Patient Health Information Network. The committee was eventually notified that the ARPA proposal was not selected for funding. Although this lack of additional funds did not hamper the development of the network, more applications and more participants will eventually need to be added to build a sustainable community network. Additional funding may be sought from other sources to help us make these additions and, thereby, reach critical mass.

Partnership accomplishments

Achievements include (a) interconnecting the seven hospitals over a leading edge fiber optic (SONET DS3), ATM (Asynchronous Transfer Mode)-switched network running through five ©Ameritech central offices in the Dayton area, (b) jointly developing and agreeing on a communitywide confidentiality policy for patient information and developing procedures to assure that patients can effectively exercise their right to maintain the privacy of their data, (c) installing ©IBM's state-of-the-art Medical Records Plus/400 computer systems in the seven hospitals to share images of patient medical records, (d) designing an interactive network query and retrieval function for easy end-user access to patient information by physicians and other authorized staff, and (e) sharing patient information among the seven participating hospitals.

The solutions we have developed enable health care providers, currently restricted to physicians and staff in emergency and medical records departments in the seven participating hospitals, to have computerized access to a brief history (up to three years initially) of all patient encounters at any of the seven hospitals. For anyone who is an inpatient (for most of the seven hospitals), a broad set of medical information (including, but not limited to, patient demographics and encounter description, history and physical, discharge summary, lab reports, radiology reports, and postoperative reports) from the inpatient encounter will be stored in an optical image database at the hospital where the encounter occurs. If the patient subsequently enters any of the seven hospitals for treatment, a virtual longitudinal medical record is available to aid in treating the patient when an authorized end user queries the distributed brief encounter index and medical information databases in the seven independent hospitals.

The unique nature of these accomplishments is evident from recent CHIN conferences (e.g., in Phoenix, Atlanta, and Columbus). Although conference participants have talked considerably about building CHINs, almost no implementations have been detailed, as could be expected given the business and technical barriers. The few CHINs that have been implemented tightly constrict the meaning of community and are more like enterprise networks since they involve a single hospital or affiliated hospitals rather than competing hospitals. Furthermore, the applications implemented are more traditional character-based applications, where a higher speed, higher cost advanced information infrastructure is not required.

SURMOUNTING BUSINESS BARRIERS

Limited incentives to collaborate and high cost of infrastructure

Given their long-standing competitive history, hospital executives are not likely to view the building of a network to share patient information with competitors as a strategic initiative. At first glance one could assume they may even be opposed to sharing information with competitors. As a result, they are more likely to view the building of a network to share information with business partners in a managed care environment a higher priority. Consequently, the incentives and resources for building and operating a health information network are often unavailable.

Why have the seven GDAHA hospitals been able to surmount these business barriers? We suggest five related explanations:

1. The hospital resources required for this demonstration health information network have been so limited that they do not compromise higher priority projects.

2. Vendors have seen their contributions as investments that will provide future returns.

3. The sharing of patient information is important for serving physicians and improving health care.

4. Patient medical information is not a strategic resource vis-a-vis competitors.

5. The hospital leaders of medical records and information systems do have incentives to provide the limited internal resources required for building and operating this network. Further discussion of these explanations illustrates how business-related barriers to a health information network were addressed and overcome.

Surmounting the high cost barrier

To build and operate the infrastructure for 2 years, the hospitals committed a total of about $800,000 in cash and full-time equivalent staff members, less than $125,000 per hospital. Over 80 percent of the total project funding came from vendor contributions. Thus, the high cost of entry to the world of health information networks was reduced so low that the network did not have to compete with other hospital priorities for capital investment. Hospital leaders of medical records and information systems were able to provide in-kind support through the allocation of limited staff time and energy to the project.

Ameritech and IBM provided financial incentives through the contribution of technology and services. Their involvement allowed them to explore market potential. Their goal was to assist network participants in achieving enough improvement in quality or cost of health care that this experience would be a model they could describe to other communities or potential participants. This experience could help Ameritech and IBM develop new business relationships if it produced benefits justifying the expense of the equipment and services participants must purchase. Such results would make a good story. The involvement of both Ameritech and IBM provide evidence that they believed the story will be a good one and that local health care markets would support networks of various participants. Their willingness to make contributions to and collaborate with the Greater Dayton Area Patient Health Information Network also provides evidence that they understand health information networks are in their early stages of development. Consequently, the benefits of such networks are not clearly specifiable and must be explored. Given the high cost of entry, the uncertain benefits, and the other barriers that must be surmounted to implement a CHIN, the vendors' support indicates they recognize it is in their interest to help support implementation. Without such support they would not have a story to tell.

Surmounting the limited incentives barrier

Surmounting the disincentive to share information

Information that gives a hospital competitive advantage is not at the granular level of patient medical records. Aggregations of that data are expensive to develop and of questionable competitive value, particularly relative to other data. Sharing patient medical records across hospitals does make it possible to provide better service to patients and the physicians who serve them, particularly when patients receive treatment in multiple locations. Thus, overcoming the barrier to share patient information was simply a matter of understanding what was to be shared and why.

Surmounting the limited incentives for hospital leaders to collaborate

Hospitals in the greater Dayton area have a history of collaboration, unlike hospitals in many other metropolitan

areas. Joint initiatives like the development of the Dayton Area Health Plan, a Medicaid health maintenance organization (HMO), and the GDAHA/ Andrews University Masters in Physical Therapy program testify to the region's ability to effectively work together. The hospital leaders who have collaborated on this project, specifically those responsible for medical records and information systems, realize they will benefit from the collaboration. Those responsible for medical records have an incentive to develop a computer-based patient record, which was the initial focus of the collaborators. Providing better service through improved accessibility of the medical record for patient care and research are examples of those incentives. Those responsible for information systems also have an incentive to collaborate on this project. For example, collaboration provides them opportunities to provide a valuable service to their medical records directors while obtaining and working with state-of-the-art technology.

SURMOUNTING TECHNICAL BARRIERS

Building the infrastructure for the Greater Dayton Area Patient Health Information Network has required us to surmount several technical barriers. These barriers include:

the lack of experience with the advanced communications technology provided by @Ameritech,

lack of a standard computer-based patient record,

the use of diverse hardware and software systems in the participating hospitals,

the lack of standards for accessing and retrieving patient information, and

the need to address the confidentiality of patient data.

This section describes how we have surmounted the barrier associated with each technical component and, where appropriate, explains the technical component.

Surmounting inexperience in using advanced communications technology

We structured the project as a 2-year demonstration project to give hospitals an opportunity to learn about the leading edge fiber optic network @Ameritech installed. The network is not currently used to support mission critical applications.

Several technical barriers were addressed by a committee of experts in network technology from @Ameritech, @IBM, each of the hospitals, and Wellfleet. Wellfleet became involved as we sought to answer the early question of how the high speed wide area network would be connected to the slower local area networks in the hospitals. We purchased connecting devices, known as routers, from Wellfleet after discovering speed incompatibilities in the implementations of new technologies provided by @IBM and @Ameritech. We subsequently discovered network incompatibility problems with the routers that have since been resolved. As implementers of new technologies we expected to encounter these kinds of problems even though we did not know exactly what they would be.

Our wide area network between **hospitals** operates at 45 million bits per second but is capable of operating at higher speeds as the need emerges. It supports transmission of not only traditional character data but also patient information that in the future will increasingly involve voice, **images**, and video. It is flexible enough to handle different volumes and speeds demanded by various players in the health care environment (e.g., radiologists conducting interactive video **consultations** throughout the day while manipulating radiologic **images** observable at each site versus a physician's office obtaining a single patient's latest lab **report**). This network should have the capacity and flexibility to accommodate changing technology and demand well into the next decade.

Surmounting the lack of a computer-based patient record

No standard computer-based medical record currently exists in the health care industry; nevertheless, a standard set of patient medical data has been agreed upon by a committee of all medical records directors from the seven participating hospitals. The agreed upon data were selected to support treatment decisions.

Reaching agreement on the patient data to include is a step toward a standard computer-based patient record. The resulting record includes, but is not limited to, patient demographics and encounter description, history and physical, discharge summary, lab reports, radiology reports, and postoperative reports. This standard medical information has been stored using @IBM's Medical Records Plus/400 system for each inpatient during the demonstration period.

In addition, each hospital agreed to use data from its master patient index to create and maintain an encounter index as the basis for accessing and retrieving patient medical information.

Each hospital is responsible for maintaining its own databases for the encounter index and patient information. This distributed database was selected over a central data repository to maintain each hospital's responsibility for managing its own data. This distributed approach avoids sensitive organizational barriers related to matters such as data security and ownership in a central repository.

Surmounting the diverse computer software and hardware barrier

To use patient medical information, CHIN participants need software and hardware to connect to the wide area network so they can query encounter indices and retrieve patient medical information. To supply patient medical information, CHIN participants also need software and hardware for storing the encounter index and patient medical information databases. We overcame part of this technical barrier by having a common set of ©IBM hardware and software at each hospital. Since five of the original six hospitals in the project were already ©IBM customers, overcoming this barrier was easier.

Getting patient information from each hospital's diverse software systems into a common format was necessary. Hospital applications programmers along with ©IBM support staff and other vendors had to develop interfaces for transferring encounter index and patient medical information from various hospital systems (e.g., patient registration, transcription, and lab) to a common format. The development of these interfaces and the movement of the data into the commonly formatted encounter index and patient medical information databases was a nontrivial task. One estimate of the human resource commitment to this task is about one-fourth of an individual's time for each hospital. For example, the head of information systems in one hospital estimated that he had an applications programmer devoted to these activities for about 6 person-months during a 2-year period.

Surmounting the lack of a standard query and retrieval capability

How do we query and retrieve the patient data residing in remote distributed databases and how do we interface this query with ©IBM's Medical Records Plus/400 system? Led by consultant and programming staff from ©IBM, a design team of health information managers and applications programming staff from the hospitals designed the query. ©IBM developed the software to implement (a) the query into the encounter indices and (b) the subsequent retrieval of requested patient medical information. Across hospitals, implementation is based on a peer-to-peer (AS/400 to AS/400) network architecture with each peer responsible for responding to peer queries to its encounter index and retrieval requests to its patient medical information database. Within each hospital, implementation is based on a client-server (workstation to AS/400) architecture with the client responsible for image display once documents are retrieved and the server responsible for all other functions, including the initiation of a network query and subsequent document retrieval. The design and development of this capability has required a significant amount of time from hospital and ©IBM staff. One estimate of the human resource commitment to this task within each hospital is about 9 person-months over a 2-year period, while for ©IBM it is about 18 personmonths over this same time.

Surmounting concerns for patient confidentiality

How do we ensure the patient's right to privacy? Although we tend to submerse ourselves in the technological parameters of information networks, it is issues such as patient confidentiality that must be successfully addressed if we are to gain community support for such endeavors. The health information managers from each of the participating hospitals convened and over several meetings began developing policy and procedures for releasing patient information. The ultimate goal of patient confidence in the security of his or her medical information was paramount.

Considerable discussion occurred before consensus was reached on a communitywide policy and procedures statement. Much of the discussion focused on how use of the network is an evolution from the current practice of sharing patient information via courier, fax, and telephone. Current policies and procedures served as the foundation for developing the new statement. Following the development of draft standards the committee requested review by legal counsel and physicians responsible for accessing patient information. Once finalized these items became a permanent part of the Greater Dayton Area Patient Health Information Network. Basically, patients must sign a release before their information can be released to another hospital, except in an emergency, where the physician may retrieve whatever available patient information the physician deems appropriate without prior patient consent, which is the same procedure the hospitals currently follow.

A CHIN makes it possible to store and retrieve patient medical information in ways that were previously infeasible. We have taken only the first step in showing that business and technical barriers can be overcome. Future steps include extending the network to other stakeholders, such as other hospitals, physicians, and insurers. Additional barriers, that is, the ongoing costs of participation, must be overcome by demonstrated benefits. One of the major unanswered questions is whether the information stored provides the benefits to justify such costs. To answer this question requires additional research on (a) how long specific patient medical information should be stored and (b) which information should be retrieved under what circumstances. Developing answers to this question also requires the deep involvement of physicians and systematic investigation. The availability of this system for storing and retrieving patient medical information across hospitals overcomes one barrier to obtaining an answer. It makes conducting such research in a field setting technically feasible. Overcoming barriers to deep physician involvement and systematic investigation must still be addressed.

A CHIN is an important tool for helping a community improve health care while controlling costs. However, the business and technical barriers to the development of a CHIN are significant. Hospitals in the greater Dayton area have overcome a number of these barriers. Given the lack of other community CHINs, the most surprising result perhaps is that these competing hospitals have overcome the limited incentives for competitors to collaborate. Although leaders in other communities can learn from our experiences in overcoming this and other barriers, they should carefully consider how our experiences can be applied in their communities. Other researchers could develop models that help community leaders better understand the barriers they will face and the steps they will need to take to develop their own CHIN.

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Finding value in EMRs

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Abstract:
On the surface, the market's assessment of the value of ambulatory electronic medical records is that it is inadequate, but a closer examination reveals that some institutions have solved the value problem. Cleveland-based Kaiser Permanent of Ohio, for instance, began developing a fully automated medical record in 1989 and today the system is fully implemented. The HMO is now planning to stop the automatic delivery of paper charts on September 1, 1997 and feels that the system that it has developed will meet all its organizational needs, and pay for itself in 5 years.

Full Text:

[Headnote]

Successful electronic medical records implementations share the ability to improve the quality of care by making clinical data readily available and offering decision support.

On the surface, the market's assessment of the value of ambulatory electronic medical records is clear.

Simply put, the value provided is inadequate.

If the value of ambulatory electronic medical records was deemed to be high enough, most physicians would be using them.

But a closer examination finds that some institutions have solved the value problem.

Despite the cost obstacle, there are a small but steadily increasing number of successful ambulatory electronic medical record implementations.

These include the Regenstrief Institute, Harvard Pilgrim Health Plan's group model, University of North Carolina, University of California San Francisco, MacNeal Health Network (described in the May 1997 issue of Health Management Technology), Kaiser Permanente's Northwest Region, and my organization, Kaiser Permanente of Ohio.

These institutions are using electronic medical records as their primary mechanism of accessing and recording medical information.

What can we learn from these organizations? Most of them have devised systems that do not decrease physician productivity. To do that, various compromises are made. Medical coders or transcriptionists may be used. Progress notes may be imaged. Pen based computers may be used. The electronic record may supplement, rather than replace the paper chart. Physicians may not be expected to do electronic order entry. Kaiser Permanente's Northwest Region accepts a small decrease in physician productivity as an acceptable cost for a higher quality patient encounter.

All these systems improve the quality of care delivered by the ready availability of clinical data and by the decision support most offer.

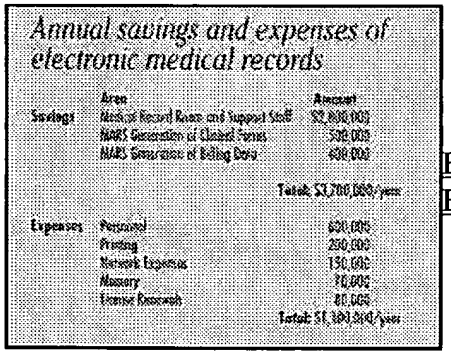
At Kaiser Permanente of Ohio, a 200,000 member health maintenance organization based in Cleveland, our original goal was to use electronic medical record systems to improve the quality of care delivered by making clinical data immediately available to physicians in a concise format, and by optimizing the care delivered using alerts, reminders and batch reports.

We began development of a fully automated medical record in 1989. Today, the system is fully implemented and we are planning to stop the automatic delivery of paper charts on September 1, 1997. We feel that the system we have developed will meet all our organizational needs, and pay for itself in five years.

We estimate the cost of system development was $10 million, which involved the planning and building of an entire network from the ground up. This included hardware such as physician and staff computers and network hardware; software, some of which was developed by Sequoia; and some salary support.

Savings generated by the system are substantial and growing. The annual salary savings are realized because of the reduced need for medical record and support staff. The savings far exceed the expense of increased information system support, including network managers. The costs associated with forms will decrease by $750,000 a year. Automating the collection of billing data saved $400,000 per year.

These are the quantifiable savings. There are many unquantifiable savings including efficiencies in patient communications due to the instant availability of medical information and the decreased need to build space to store paper medical records.



Enlarge 200%
Enlarge 400%

Annual savings and expenses of electronic medical records

The first step in developing the HMO's Medical Automated Record System (MARS) was to implement an encounter system which collected and presented, at the time of a visit, data elements such as diagnoses, allergies,

medications prescribed, immunizations, vital signs and smoking status. Data collection began in 1991 on all our members and today we have information from more than four million encounters. This data represents a crucial part of a patient dataset and has enabled us to develop many functionalities.

The MARS has resulted in impressive improvements in the quality of care delivered. Physician reminder notices generated by the system have increased compliance with guidelines for the use of medications in coronary artery disease patients, such as aspirin and cholesterol lowering agents. Reminder notices have been used to stratify the organization's entire diabetic population as to the risk for amputation. The system tracks all diabetics, at medium or high risk, for the appropriate intervention, a podiatry visit with patient education. The system tracks hypertensives so they are not lost to follow-up. The entire asthmatic population is being stratified as to severity level, and reminder notices are generated, when moderate or severe asthmatics are seen, regarding the prescription of guideline medications.

Reminders are also used to improve compliance with influenza immunization. An extract, from the system's database, is used to trigger an automated telephone calling device to notify older patients who have not had a flu shot by a target date. The system also supports the organization's smoking cessation program, which has been effective in reducing smoking prevalence.

MARS has allowed reductions in the size of the large medical record room staff needed to deliver charts in twelve different buildings and affiliated hospitals. It is systematically eliminating the need to purchase, warehouse and distribute the 170 clinical forms used by the organization. MARS can print the forms as needed. MARS reminders are used to improve compliance with the pharmaceutical formulary. Lastly, MARS produces electronic data necessary to generate bills.

Ambulatory electronic patient record implementations that have failed typically required heavy physician keyboard data entry, which decreases physician productivity. They may require the entry of large new data sets or interfere with physician workflow. Training requirements may be significant, and therefore, expensive. Physicians who see patients for many insurers find it unreasonable to spend many hours learning the systems of different companies.

Many of the institutions that have successful implementations use a turnaround document. A turnaround document is typically printed by the computer system, and contains a concise summary of individualized patient information. Charting is done directly on the document and crucial data elements are added to the system, some time after charting, by one of a variety of mechanisms which might include medical coders or optical mark sensing.

In Kaiser Permanente of Ohio, we have a staff of 20 medical coders who update our diagnosis, medication, allergy and vital sign databases. The coders also designate ICD codes if our coding software is unable to do that. The use of coders entails an ongoing salary expense, but in our case it resulted in a significantly reduced cost in building our system, and increased physician acceptance of the system.

Our automated medical record also captures progress notes and visit and procedure CPT codes. It will soon capture health risk assessment information and outcomes information. We developed a forms generation capacity to replace the 170 clinical forms used in our organization. MARS does all this by using a combination of optical scanning and optical mark sensing. When a document is scanned, its image is retained, and also sent to the medical coder. The procedure sheet used by Kaiser Permanente of Ohio is an optical mark sense form. This is scanned along with the progress note; the system extracts data automatically.

To maximize the efficiency of our physicians with the system, we are printing a five-page packet of essential clinical information which we hope is adequate for 80 percent of patient visits. Clinical information that is not printed in the packet is available online, either through a graphic user interface (developed internally) to digitized data (lab results, radiology **reports**, diagnoses, vital signs, immunizations, allergies, smoking status, medications prescribed, medications dispensed, dictated progress notes and **consultations**, Emergency Department notes, and **hospital** discharge summaries) on the mainframe, or through **images** of scanned documents. The **images** are on a clientserver system using a proprietary product, medSTAR (Sequoia Software, Inc.).

This approach, while not "pure" in that it uses paper, does help the organization achieve its quality and cost goals in a way that is supported by physician users. E

[Footnote]
(Editor's Note: Kaiser-Permanente of Ohio is one of three winners of this year's Nicholas E. Davies CPR Recognition Program, an award given by The Computer-based Patient Record Institute (CPRI),

Schaumburg, Ill., for significant strides toward a comprehensive electronic medical record.)

[Author note]
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[Author note]
Allan Khoury, M.D., Ph.D. is the associate medical director for medical information at Ohio Permanente Medical Group, Cleveland. His honorarium will be donated to the Muscular Dystrophy Association of Ohio.
